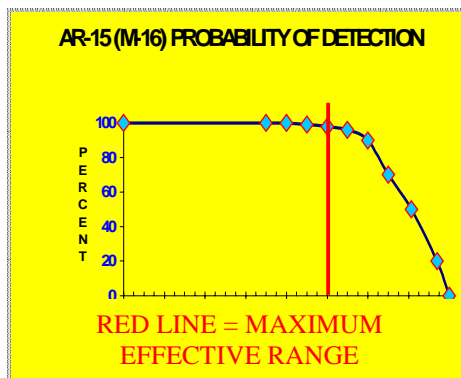


## Passive Infrared Detection of Guns and Ordnance

The Tactical Electronic Warfare Division of the Naval Research Laboratory has been working with passive infrared (IR) detection of small arms and ordnance since 1993. The two main systems that have resulted are the Vectored Infrared Personnel Engagement and Returnfire (**VIPER**) small arms detection and the Battlefield Ordnance Engagement - Network Centric Employment ( **BOUNCE** ) systems.



The **VIPER** equipment consists of a mid-wave IR camera, together with real-time signal processing, magnetic compass, and user display and alarm. It provides both gun detection within 70 ms after gunfire and geolocation of the firing event. A passive acoustic component (microphone) or a laser rangefinder can be incorporated to determine range to the gunfire.



The **VIPER** has many modes of operation. These include:

- static operations for protection of high-value targets (embassies, etc.)
- mobile operations on vehicles (HUMMWV, LAV, etc.)
- networked mobile operations - dismounted troops near HUMMWV, etc.
- man-portable operation (requires some weight reduction and R&D)

The **VIPER** has been integrated with gimbals and high-resolution visual cameras for law enforcement purposes as well as for target identification that assists when returning fire. It has been tested extensively against more than 10,000 rounds from various small arms and works beyond the maximum effective ranges of the weapons.



The **BOUNCE** system has been developed for use in tactical unmanned aerial vehicles (UAVs) that will be able to fly underneath clouds in order to locate and classify enemy ordnance. It can also be used to correct

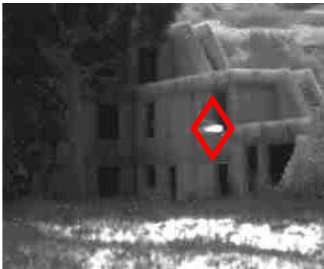
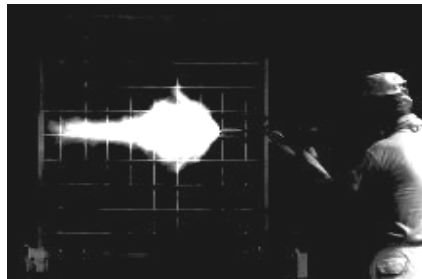


**SIERRA**  
tactical UAV

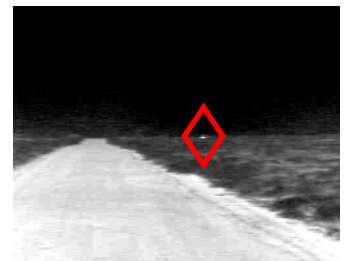
offensive-fire targeting and provide high-resolution imagery for battle damage assessment. It consists of an IR camera, GPS, attitude sensors, image processing, a gimballed visible zoom camera with laser rangefinder, and ground and user stations. A two-platform air payload experiment using the **BOUNCE** systems will be completed in 2003 under the sponsorship of the Office of Naval Research Swampworks program. This will demonstrate network-centric capabilities and provide "over the hill" situational awareness to ground forces. It is primarily designed to detect guns, mortars, and artillery fire in the 1 to 10 km range for tactical use.



Advanced work in the passive IR gun/ordnance detection technology area is currently being pursued. The advanced development includes: refinement of motion algorithms to operate in high-clutter urban (MOUT) scenarios; development of techniques for dismounted warfighters; and applications of lower-cost, lighter-weight IR cameras.



*Upper left: Detections of shot from a window  
Upper Right: Detection shot reflected off inner wall  
Lower Left: Detection of shot partially obscured  
Lower Right: Detection of shot at extended range*



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